

**National Science Foundation
Directorate for Computer & Information Science & Engineering
Division of Information & Intelligent Systems**

**Management Response to the
Committee of Visitors Report
October 2009**

Introduction

The Division of Information & Intelligent Systems (IIS) of the Directorate for Computer & Information Science & Engineering (CISE) at the National Science Foundation (NSF) held a 3-day Committee of Visitors (CoV) meeting on May 19-21, 2009. The purpose of this meeting was to provide NSF with an assessment of the quality and integrity of the program operations pertaining to proposal decisions and to comment on how the results generated by awardees have contributed to NSF's mission and strategic outcome goals. The CoV review covers the period of FY 2006 through FY 2008.

The CoV consisted of 15 members, including a Chair and a CISE Advisory Committee Member, selected for their expertise in the core areas of research in IIS. The CoV was divided into groups according to their expertise when preparing their report on outcomes; in groups of distributed expertise when preparing their report on quality of review processes; and worked as a whole to prepare their executive summary and synthesize their individual reports. The CoV members were provided with a comprehensive set of materials on a web-based collaborative portal, including a random sample (149) of all of the proposals (5163) received by IIS during the review period; workshop reports; a detailed self study providing an overview of the Division activity and management during the review period; a template for the CoV report including links to statistical data relevant to specific questions; past CoV reports and IIS management responses to those reports; and other material relevant to IIS activities. The CoV heard presentations from the Division Director, Deputy Division Director, and Program Directors for each of the three core areas: Human Centered Computing (HCC), Information Integration and Informatics (III), and Robust Intelligence (RI). We are extremely grateful to the members of the CoV and the Chair for their commitment and willingness to serve NSF and for the energy and enthusiasm they brought to this activity.

Major Findings

The CoV reported three main findings in the executive summary:

1. *"The IIS Division is very well managed, with a reviewing process that has high integrity and quality."* The CoV was very positive throughout the report about IIS management and staff and how they work as a team, are aware of the scientific challenges of the field, are adapting their processes to adjust to its fast pace of

change, and are willing to listen and take risks when appropriate.

2. *“The portfolio of research being funded by IIS is exciting, innovative, interdisciplinary, and far-reaching. It covers the broad range of fundamental research questions about the interactions of people, computers, and information within a range of contexts—questions whose answers are critical to solving problems in areas from energy to education, from health-care to sustainability to economic well-being.”* The CoV explained that *“IIS outcomes are ... expand[ing] people’s abilities to learn, make decisions, communicate, collaborate and achieve goals”* and commented on how IIS’s *“new programs cut across disciplinary boundaries as well as ... artificial [organizational] boundaries”*.
3. *“The amount of funding for research in these fields, and the amount of staff support for the IIS team, have not kept pace with the growing importance and concomitant needs of IIS research.”* The CoV expressed concern that funding *“has not kept pace with the growth of the field, and acceptance rates have dropped noticeably”* over the three year period under review. The CoV has asked that this be *“carefully monitored”*, and particularly expressed concern for *“a dedicated staff spread thin and making compromises in terms of the time they spend in the field and the effort they can devote to developing new programs”*.

We are pleased to acknowledge the first two findings without further discussion, and focus in the remainder of this Major Findings section on the third finding and related issues expressed in other parts of the report.

Workload

CoV Finding: The CoV expressed concern about the growing workload for IIS Program Directors, noting their increasing engagement in cross-cutting activities, which the CoV attributed to the centrality of IIS research. The CoV also noted that if workload continues to grow, it will be increasingly challenging to meet NSF customer service standards such as proposal dwell time goals.

Management Response: There is no doubt that workload demands on staff continue to grow, in IIS, in CISE, and in NSF overall. The CoV perceptively attributes this growth in workload to both increasing proposal pressure¹ (true in IIS, in CISE and in NSF), and to

¹ The 2006-2008 data available to the CoV regarding proposal pressure misrepresented proposal pressure trends because of anomalies in the way in which IIS collected proposals in FY 2006. Further analysis of proposal pressure trends over a longer period indicate that an increase in IIS proposal pressure took place through 2004, followed by a decrease in proposal pressure after the imposition of investigator limits in IIS’s core programs. A resumption of proposal pressure increases appears during the CoV period of 2006 and 2008, as noted by the CoV, but at a fairly modest rate of ~15%.

the increasing multi-disciplinarity of our scientific priorities and opportunities. NSF (and CISE) will continue to seek increases in our operations budget that will allow us to hire more staff in key areas. Like the CoV, we are concerned that we will be unable to meet our customer service standards if workload grows without concomitant increases in staffing. In the meantime, CISE has taken action to manage proposal pressure workload, imposing proposal limits in our core and cross-cutting programs. It is certainly true that we face a constant tension between undertaking additional or new activities that would clearly provide scientific value to CISE, NSF and the academic community, and increasing workloads to levels that might be harmful. We will seek to continue to improve the thoughtfulness that we bring to pursuing our scientific ambitions within our staffing and workload constraints.

Success Rates

CoV Finding: The CoV expressed concern that the amount of funding available has not kept pace with the growing importance and concomitant needs of IIS research, and the CoV encouraged NSF to look for future opportunities to increase funding rates for IIS to fuel the Nation's future innovation, but also the diverse and growing number of researchers who are naturally attracted to the important areas that IIS supports.

Management Response: Low success rates continue to be a concern in each of the CISE divisions (see also the CCF and CNS CoV reports) and in NSF overall. We will continue to make a strong case for increased investments in computing, recognizing the critical role the field has to play in addressing many of our national priorities.

New Investigators

CoV Finding: The CoV expressed concern that the funding rate for first-time proposers was lower than that of prior recipients.

Management Response: Success rates are generally lower for new Principal Investigators – this is true in CISE, and in NSF as a whole - and indeed might be expected when receiving proposals from less experienced scholars and funding seekers. However, we are pleased to note that in fact, the difference in success rates between new Principal Investigators and those who have submitted proposals previously actually narrowed over the review period, indicating increasing IIS attention to new investigators. The CoV suggested *“that continued vigilance and creativity are desirable to encourage promising new investigators,”* a sentiment we wholeheartedly agree with.

Cuts on Award Budgets

CoV Finding: The CoV notes that, in the data available to them, only 52% of the funded proposals received 90% or more of their requested budgets, and they expressed concern that this was negatively impacting the scope of individual projects.

Management Response: This concern was also raised by the CCF and CNS CoVs. And indeed, there is a persistent tension between fully funding proposal requests, and optimizing the number of high quality grants made. There are many reasons for cutting the budget of a project, such as removing items from a budget that are not ultimately justified for the proposed research, decreasing the scope of work to respond to reviewers' comments, and seeking equity across awards by funding similar projects at similar levels. Program Directors inject a fair amount of energy into this activity since they are aware that freeing up funds on one project may ultimately enable another project to be funded. IIS management has already taken proactive steps to monitor budget reductions by establishing a policy that all budget cuts over 10% need to be approved by the Division Director, and that all budget cuts must be explained in the Program Director's Review Analysis. This allows for greater reflection on and transparency of budget cuts at the Program Director, Program Cluster, and Division levels, and better understanding of budget changes by future CoVs and others who may need to inspect such matters. The other two CISE divisions are implementing this policy too.

Program Director Professional Development

CoV Finding: The CoV expressed concern that workload increases may potentially reduce the opportunities Program Directors have to interact with the broader research community, and encouraged NSF to consider ways in which permanent staff can renew themselves technically, much as academic faculty do through sabbaticals.

Management Response: CISE recognizes the importance of providing professional development opportunities for Program Directors, opportunities that range from attendance at conferences and workshops to longer-term "*sabbaticals*." We can directly confirm some aspects of the CoV's concerns regarding the trade-offs made between allocating time and resources to professional development and community interactions, and managing a growing workload. For example, although Program Directors specify at the start of the year the conferences they would like to attend, we find that some Program Directors cancel scheduled professional travel due to workload impositions. To better manage travel budgets, IIS has started coordinating travel plans across clusters of Program Directors in IIS's core areas, using this process to also ensure that NSF is represented at as many of the major conferences as possible that are relevant to each cluster. This has required Program Directors to be thoughtful about their travel, typically prioritizing travel to the professional gatherings that are closest to their NSF responsibilities, consistent with the CoV's wishes. We will continue to use our travel-plan process in this fashion. We will also continue our ongoing efforts to encourage Program Directors to maintain, Independent Research/Development (IR/D) plans – the mechanism by which Program Directors pursue their own research interests – efforts that have, for example, increasingly resulted in more IR/D plans for long-time Program Directors. IIS management will also encourage PDs to consider long-term

professional development assignments (such as sabbaticals) as workload demands permit.

Other Findings and Recommendations: IIS Program Management

Overall, the CoV was laudatory about IIS' management and processes and the outcomes they enabled. In this section we summarize the CoV's position on IIS' scientific priorities, followed by suggestions they provide for achieving further excellence in program management.

Scientific Directions

CoV Finding: The CoV was impressed with the portfolio of research being funded by IIS, noting that it covers both traditionally important as well as emerging areas in the studies of the interrelationship between people, computers, and information and commended IIS for its work with other units such as OCI and SBE because interdisciplinary connections are essential to the IIS mission. The CoV expressed support in numerous places for the scientific directions taken by IIS' programs, emphasizing the important role that IIS' research on the interrelated roles that computers, people, and information has for our country. Quoting the report:

[T]he IIS division deals with computing in its most strategic aspects. ... Many national priorities are deeply entwined with IIS subject matter, which bear a critical and ubiquitous relation to humans and human infrastructure.

The report also points out that the U.S. is not alone in appreciating the value of IIS research areas, and identifies examples where American competitiveness may be at risk due to significant new investments in IIS areas by other countries.

Management Response: Moving ahead, IIS will continue its support “of research that include new enabling technologies, fundamental theoretical advances, and new capabilities that expand people’s abilities to learn, make decisions, communicate, collaborate and achieve goals” achieving “outcomes that affect users of information technologies, personal computers, educational technologies, health informatics, web-based search and information retrieval, digital libraries, robotics, mobile devices and much more.” We are also delighted that the CoV recognizes the valuable role IIS has been playing in a number of multidisciplinary research and education programs. For example, IIS staff has been participating energetically in the Cyber-Enabled Discovery and Innovation (CDI) Program, an NSF wide initiative on multidisciplinary research on innovations in computational thinking. Furthermore, IIS has a track record of initiating and leading such multidisciplinary programs, including Advanced Learning Technologies (CISE, EHR), Collaborative Research in Computational Neuroscience (CISE, BIO, MPS, SBE, NIH), CreativeIT (CISE, SBE, ENG, EHR), Digging Into Data (CISE, NEH), and Social-Computational Systems (CISE, SBE). We anticipate such IIS efforts continuing for the

foreseeable future (albeit to the extent to which the workload issues discussed earlier may allow).

In the remainder of this section we discuss the CoV's suggestions to help IIS continue its efforts to support such critical research efforts.

Program Reviews

CoV Finding: The CoV noted that while IIS continues to pay significant attention to the evolution of its portfolio, it was not clear whether there was a carefully orchestrated process for strategic planning and portfolio development, or whether evolution is left to being more organic. The CoV also noted that the III program seemed less cohesive than those in HCC and RI, and encouraged management to give periodic attention to the III scientific portfolio and priorities in order to discover new relationships, opportunities, and directions.

Management Response: Although IIS had reviewed the scientific scope of its programs multiple times over the period considered in the CoV review, the CoV is correct that such reviews have generally been opportunistic rather than well-integrated into the division's strategic planning and operations. Initial steps to integrate programmatic review into routine Division activities have already begun by IIS's institution of a process by which each program must present to the Division's leadership the current year's proposed portfolio, focused particularly on exciting and emerging new topics. IIS will initiate a yearly review of each program's strategic scientific directions at the start of each fiscal year, with special consideration given to the III program. A similar process will also be established in CCF and CNS.

Broadening Institutional Participation

CoV Finding: The CoV noted that NSF funding largely supports major research universities, and saw value in exploring new ideas for supporting faculty and students at institutions less able to attract NSF support. They proposed that the Division consider the creation of networks of faculty and students, expressing the hope that such projects could *"ensure that faculty outside the leading research universities [gain] insight into the world of cutting-edge research, and that their students consider research careers"*.

Management Response: CISE has supported networks of people in emerging areas of research with workshops and doctoral consortia at conferences relevant to CISE research. The Division will consider this and examine if there are additional opportunities to create such networks, including opportunities created through the CISE-wide BPC and CPATH Programs.

Other Findings and Recommendations: IIS Review Management

The CoV responded positively to the quality of IIS's review processes and management, stating, for example, *"IIS is effective in maintaining the quality of the merit review process in a scientific area that is undergoing rapid change."* Nonetheless, they provide suggestions where we could seek even greater excellence.

IT Support for Proposal Management

CoV Finding: The CoV recommended that NSF investigate the use of technology that facilitates the management of proposals in core and emerging areas. Their comments reflect that the current tools available to NSF staff facilitate the review processes associated with a single proposal at a time. There are no tools available to see proposal topics in groups, monitor emerging areas, or otherwise respond to a range of information needs for effective proposal and program management.

Management Response: NSF is always updating its tools for managing proposals and CISE Program Directors participate in this process. CISE has established a Just Use IT committee to encourage Program Directors to try new technologies that will facilitate the review processes. Further, CISE and SBE have established a Subcommittee of their Advisory Committees to identify a range of technologies that can assist in analyzing and visualizing a given set of proposals. The recommendations from the Subcommittee will be considered by CISE and the Divisions to determine a feasible technology approach. Such outcomes would not only impact the review process, but program management more generally.

Reviewer Expertise

CoV Finding: Although the CoV acknowledged Program Director (PD) efforts to seek expert panels with broad expertise, they also noted that that some reviews contain *"superficial feedback"* to proposers, ascribing such cases to variance in expertise due to the breadth of topics considered by IIS's cluster-based solicitations. The CoV recommended that NSF elicit some self-assessment from reviewers about their expertise on the topics of the proposals that they review.

Management Response: This recommendation is consistent with the broad disciplinary practice familiar to many panelists who conduct conference paper reviewing, whereby reviewers provide both an overall rating and a self-assessment of expertise for a given paper. The CoV demonstrates appreciation that the challenge in staffing panels is to ensure that there is sufficient expertise on the panels for the topics arising across all of the proposals on a given panel, and that this is particularly challenging in IIS given the increasingly diverse and multi-disciplinary projects that we receive. In fact, many Program Directors seek reviewer feedback about proposal preferences, which correlate with expertise, before finalizing a panel and assigning proposals to reviewers. Program Directors are also pro-active in panels, reviewing reviews submitted and seeking additional reviews if a reviewer is concerned that they do not have the appropriate

expertise to review a proposal or parts of the proposal. We are currently investigating means by which we might expand the ways in which we might identify gaps in panel expertise before a panel is finalized.

Geographically Expanding IIS's Reviewer Pool

CoV Finding: The CoV notes that by holding all panels at NSF we limit participation by people with varied geographic constraints. They propose that NSF consider establishing a sustained presence on the West Coast for holding panels.

Management Response: IIS has held panels in the Silicon Valley area in the past, and although we agree with the CoV about the value of expanding the reviewer pool in this fashion, we must consider the administrative challenges in doing so. We will consider this possibility anew given the changing technologies now available to NSF for managing panels. Further, as acknowledged positively by the CoV, we are also aggressively pursuing other technologically enabled reviewing modalities to achieve similar ambitions, including teleconference panels, video conference panels, hybrid physical and virtual panels, and NSF's first panels held in a virtual world. We believe such approaches will provide more sustainable solutions for IIS and NSF.

Reviewer Database

CoV Finding: The CoV noted that IIS would gain value from establishing an explicit reviewer database, in contrast to the more informal reviewer information maintained by individual Program Directors.

Management Response: NSF is investigating approaches for collecting information about potential reviewers in the form of a reviewer database. CISE is participating in this process and will monitor its outcomes for possible IIS adoption.

Broader Impacts

CoV Finding: The CoV notes that communication about the meaning of NSF's Broader Impacts criterion could be improved.

Management Response: This issue was also discussed in the CCF and CNS CoV reports. Ensuring that PIs consistently and substantively describe Broader Impacts in their proposals has been an ongoing challenge at NSF as well as in CISE. NSF and CISE have provided the community with access to information about Broader Impacts, including representative [examples](#) that can be accessed from [CISE solicitations](#), and at every CISE panel meeting reviewers (who are invariably PIs themselves) are briefed on the importance of addressing Broader Impacts in their review of proposals. Despite these efforts, we see inconsistent attention to Broader Impacts in CISE proposals. Nonetheless, we remain committed to helping the PI community respond more

effectively to this important criterion. In FY 2010, CISE will publish a Broadening Participation in Computing Strategic Plan that, amongst other things, will provide CISE PIs with access to resources and ideas they can leverage to better address the Broader Impacts criterion. Furthermore, we plan to build on the success of several NSF-led broader impact initiatives, such as the [Broader Impacts Showcase](#) organized by the Division of Chemistry of the Mathematical and Physical Sciences Directorate and other similar initiatives in diversity and broadening participation organized by the Engineering Directorate to explore new ways to educate the community about broader impacts and allow principal investigators to discuss and engage in a wide range of broadening activities that can enrich CISE's sponsored research portfolio.

Other Findings and Recommendations: Technical Concerns

The CoV included three specific procedural/technical recommendations that we discuss briefly here to conclude our response to the 2006-8 CoV report.

Minority Status Self-Reporting

CoV Finding: The CoV was concerned with the large number of “*unknown*” responses to questions regarding minority status on NSF proposals. In discussions during their visit they conjectured that the design of the form for obtaining such responses may be the cause of this, rather than individuals choosing not to report minority status.

Management Response: CISE will raise this with NSF leadership to assess whether modifying the form would improve our ability to gather important data about underrepresented groups.

CoV Data Preparation

CoV Finding: The CoV notes that their efficiency would have been increased had they been provided with additional material ahead of time. They noted that during the meeting, members made several requests for specific data that were not obviously available from the initial data that they were given, and that these data were crucial for understanding the context necessary to make informed decisions.

Management Response: The CoV report lists various data resources that they believe would have been useful to them. CISE will be sharing this information with those at NSF who guide the CoV process so that it can inform how future CoVs are implemented.

CoV Report Template

CoV Finding: The CoV recommended that the CoV report template not be table-based because this makes it unstable across different versions of WORD and different platforms, creating unnecessary formatting challenges.

Management Response: The CoV had significant difficulty inserting their report – written in a distributive fashion by its members – into the Microsoft Word template provided by NSF. After much frustration the Chair of the CoV asked for IIS support to edit the report and remove the numerous formatting errors incurred by the design of the template. IIS had no easier time with the template, facing challenges even with as simple a task as cutting text from the CoV report for inclusion in this document. It is unfortunate that this caused the CoV to end its activities with some dissatisfaction. CISE will be sharing its experiences with the CoV template with those at NSF who can consider changing it to be easier to use in the future.